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First Named Inventor:	KOBE, JAMES J.		
Application No.:	10/066990	Group Art Unit:	1771
Filed:	February 4, 2002	Examiner:	Hai Vo
Title:	FLAME RETARDANT FOAMS, ARTICLES INCLUDING SAME AND METHODS FOR THE MANUFACTURE THEREOF		

BRIEF ON APPEAL

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P.O. Box 1450
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March 22, 2004
Date

Signed by: Carrie M. Arcand

Dear Sir:

This is an appeal from the final Office Action mailed on October 31, 2003 (Advisory Action mailed February 17, 2004). This Brief is being filed in triplicate. The fee required under 37 CFR §1.17(c) for the appeal should be charged to Deposit Account No. 13-3723.

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REAL PARTY IN INTEREST

The real party in interest is 3M Company (formerly known as Minnesota Mining and Manufacturing Company) of St. Paul, Minnesota and its affiliate 3M Innovative Properties Company of St. Paul, Minnesota.

RELATED APPEALS AND INTERFERENCES

Applicant is not aware of any related appeals or interferences.

STATUS OF CLAIMS

Claims 1, 2, 4-15 and 23 are pending and are the subject of the present appeal.

Originally, the present Application was filed to include claims 1-22.

In the amendment filed on May 15, 2003, claims 23-26 were added while claims 16-22 were withdrawn in response to a restriction requirement.

With the amendment filed on September 30, 2003, claims 1, 2, 4 and 6 were amended. Claims 3, 16-22 and 24-26 were cancelled. Claims 1, 2, 4-15 and 23 remained pending

On December 31, 2003, Applicant filed a written response to the final Office Action of October 31, 2003. Applicant's response included no additional changes to the claims.

STATUS OF AMENDMENTS

No claim amendments were filed after the final Office Action of October 31, 2003. Applicant's written arguments submitted in response to the final Office Action were entered for purposes of this appeal (see Advisory Action of February 17, 2004).

SUMMARY OF THE INVENTION

This present invention generally relates to flame-retardant adhesive articles. (Specification, p. 1, lines 7-8; claim 1).

Articles incorporating a polymer foam core are characterized by the density of the foamed polymer being lower than the density of the pre-foamed polymeric matrix. The lowered density for the foam may be achieved in several known ways such as by foaming with chemical blowing agents or by interspersing microspheres within the matrix. Microspheres are typically made of glass or polymeric materials. (Specification, p. 1, lines 11-15). In applications for tapes and other articles, a fire retardant feature may be needed and, in certain applications, may be required by applicable regulations. (Specification, p. 1, lines 27-28).

Adhesive tapes for electric or electronic applications may be exposed to electrical current, to short circuits, and/or to heat generated from the use of the associated electronic component or electrical device. Consequently, industry standards or regulations may impose conditions on the use of such tapes that require qualifying tests be performed on the tapes. For electrical and electronic applications, the industry standard flammability test is Underwriters Laboratories -- UL 94 "Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances". (Specification, p. 1, line 28 to p. 2, line 2).

Rail transit and transportation applications require adherence to American Society for Testing and Materials ASTM E662 ("Test Method for Specific Optical Density of Smoke Generated by Solid Materials") and ASTM E162 ("Test for Surface Flammability of Materials Using a Radiant Energy Source"). In aerospace applications, the testing criteria for the Federal Aviation Administration, F.A.R. § 25.853 (July 1990) vertical burn test, subparagraph (a)(1)(i), relates to materials used in interior aviation compartments occupied by crews or passengers, including interior ceiling panels, interior wall panels, partitions, galley structures, large cabinet walls, structural flooring, and materials used in the construction of stowage compartments. F.A.R. § 25.853 (July 1990) subparagraph (a)(1)(ii) relates to materials for seat cushions, padding, decorative and nondecorative coated fabrics, leather, trays and galley furnishings,

electrical conduit, thermal and acoustical insulation and insulation covering air ducting, joint and edge covering and the like. The materials used in aviation applications must be self-extinguishing when tested vertically in accordance with the procedures of F.A.R. § 25.853 (July 1990) (a)(1)(i) and (a)(1)(ii). In addition to the foregoing standard for aviation, both rail transit and aerospace applications are governed by Boeing Specification Support Standard, BSS 7239 ("Test Method for Toxic Gas Generation by Materials of Combustion") which requires the analysis of combustion gases. BSS 7239 includes specified concentration limits for toxic gases including HCN, NO_X, CO, HCl, HF, and SO_2. (Specification, p. 2, lines 2-20).

In order to meet the requirements imposed on them in the foregoing applications, tapes and other articles may be made with materials that are naturally resistant to fire as well as materials that have been processed or manufactured to impart a fire retarding or fire resistant quality by incorporating fire retardant agents and the like. (Specification, p. 2, lines 21-24). In electric and electronic applications, for example, it may be desirable to use foam materials possessing flame retardant properties. However, the manufacture and use of satisfactory fire retardant foam tapes used in electronic applications has been problematic because the inclusion of fire retardant substances in a foamed pressure sensitive adhesive often diminishes the effectiveness of the adhesive. This is especially challenging for two-sided fire retardant foam tapes (e.g., those with two adhesive sides). Moreover, fire retardant skin adhesives applied to one or both major surfaces of a fire retardant foam have performed poorly, further preventing serious consideration of fire retardant foam tapes in electrical or electronic applications, transportation applications, and aerospace applications. (Specification, p. 2, line 25 through p. 3, line 5).

The present application provides fire-retardant foamed adhesive substrates (e.g., tapes, in particular, double sided tapes), that strongly bond or adhere to surfaces so that foam and tape articles can be designed for use in new applications. In one aspect, the invention provides a flame retardant article, comprising: An expanded polymeric foam material comprising a polymer, a non-halogenated, antimony-free fire retardant and a plurality of microspheres, the foam material having an outer surface, the expanded polymeric foam material is a sheet with first and second major surfaces; an adhesive layer formulated without fire retardant and disposed on at

least a portion of one of the first or second major surfaces, and wherein the amount of the polymeric microspheres is from about 0.1 parts by weight to about 20 parts by weight based on 100 parts by weight of polymer. (Specification, p. 3, lines 6 – 18; claim 1).

The polymeric foam material may be selected from any of a variety of polymeric materials such as acrylate polymers and methacrylate polymers, acrylate and methacrylate copolymers, and combinations of the foregoing. Foam layers comprising a copolymer of ethylhexyl acrylate and acrylic acid are described as well as foams comprising a copolymer of isooctyl acrylate and acrylic acid. Other foam layers such as thermoplastic polymer materials including synthetic block copolymer adhesives may also be used. The adhesive layer may be a pressure sensitive adhesive such as, for example, a copolymer of ethylhexyl acrylate and acrylic acid, a copolymer of isooctyl acrylate and acrylic acid, a rubber based adhesive, a silicone adhesive, a blend of rubber based adhesive and acrylic adhesive, and combinations thereof . Likewise, the adhesive layer may be a heat-activated adhesive. The antimony-free fire retardant may comprise an intumescent material such as ammonium polyphosphates. Either or both of the foam layer and/or the adhesive layer may be provided with polymeric microfibers to impart stretch release properties to the article. The microfibers may comprise copolymers of polyalkylene resins such as ethylene copolymerized with a C_3 – C_{10} alkylene. Typical microfibers may comprise a copolymer of polyoctene- ethylene, and/or a copolymer of polyhexene- ethylene, for example. (Specification, p.3, line 19 through p.4, line 4).

A representative example of a foam article according to the invention is shown in Figure 1 of the application. The article is in the form of a sheet 10 having a first flat surface 12 and a second surface (not shown) opposite the first surface 12. At least one fire retardant is interspersed throughout the foam sheet 10. The fire retardant materials are antimony-free. The foam sheet 10 further comprises a polymer matrix with a plurality of expanded cells 14 interspersed within the matrix. The expanded cells 14 are the result of the foaming process used in the manufacture of the sheet 10 and may be created through the use, for example, of chemical blowing agents or by the inclusion of expandable polymeric or glass microspheres or combinations thereof. If microspheres are included in the manufacture of the sheet 10, the cells 14 typically comprise the polymer microspheres in an expanded and unbroken form. A skin

adhesive layer 16 is provided on one of the surfaces of the sheet 10. The adhesive 16 may comprise any of a variety of adhesive materials such as a pressure sensitive adhesive formulated without fire retardant materials therein. A release liner 18 may optionally be included to protect the adhesive layer 16 prior to the application of the adhesive 16 to another substrate or the like. (Specification, p. 6, lines 12-29).

Other layers and/or structures may be applied or affixed to the first surface 12 of the sheet 10. In associating other layers or structures with the surface 12, a layer of a skin adhesive may first be applied to the first surface 12 to bond the additional layers or structures to the surface 12. Likewise, the sheet 10 may be provided as a two-sided tape having another adhesive layer on the surface opposite the first surface 12. A release liner may be associated with the skin adhesive(s) on either or both of the surfaces of the sheet 10. (Specification, p. 6, line 30 through p. 7, line 4).

ISSUES ON APPEAL

I. Whether claims 1-2, 4-12 and 15 are unpatentable under 35 U.S.C §103(a) in view of Gehlsen et al. (U.S. 6,103,152) and Parsons et al. (U.S. 5,851,663).

II. Whether claims 13 and 14 are unpatentable under 35 U.S.C §103(a) in view of Gehlsen et al. (U.S. 6,103,152) and Parsons et al. (U.S. 5,851,663) as applied to claims 1 and further in view of Bonk et al. (U.S. 4,751,269).

III. Whether claim 23 is unpatentable under 35 U.S.C §103(a) in view of Gehlsen et al. (U.S. 6,103,152) and Parsons et al. (U.S. 5,851,663) as evidenced by Mochizuki et al. (U.S. 6,139,998).

GROUPING OF CLAIMS

For purposes of this appeal, the appealed claims will stand or fall together. No admission, however, is being made with respect to the obviousness of the subject matter of the dependent claims with respect to the subject matter of the independent claims.

ARGUMENT

I. Whether claims 1-2, 4-12 and 15 are unpatentable under 35 U.S.C §103(a) in view of Gehlsen et al. (U.S. 6,103,152) and Parsons et al. (U.S. 5,851,663).

As is acknowledged in the above "Summary Of The Invention" section, U.S. Patent No. 6,103,152 issued to Gehlsen et al. on August 15, 2000 describes articles that include a polymer foam matrix and one or more expandable polymer microspheres. The foam microstructure is characterized by a plurality of enlarged polymeric microspheres distributed throughout the polymer matrix. At least one of the microspheres is still expandable so that, upon the application of heat, it will expand further without breaking. The articles of Gehlsen can include a polymer foam with one or more separate adhesive layers bonded to the foam (col. 2, lines 61-62). However, Gehlsen does not teach or suggest the inclusion of fire retardant compositions in the foam layer in combination with an adhesive layer formulated without fire retardant.

In the Advisory Action of February 17, 2004, the Office asserted that Gehlsen teaches an article with fire retardant included in the foam layer in combination with an adhesive layer formulated without the fire retardant. In support of this assertion, the Office cited Gehlsen, examples 1-5, col. 14, lines 45-60. However, a review of the cited disclosure includes no discussion of a fire retardant foam combined with an adhesive layer that is free of the fire retardant. Indeed, both the foam layer and the adhesive layers are clearly free of fire retardant. The portion of the Gehlsen reference cited by the Office is reproduced below:

> The foam sheets in Examples 1, 2, 4, and 5 were bonded (e.g., laminated) to a two-layer film adhesive using pressure from a nip roll to make a tape. The first layer of the film adhesive was prepared by dissolving 10 parts polyamide (Macromelt 6240 from Henkel) in a solvent blend of 50 parts isopropanol and 50 parts n-propanol, coating the solution onto a release liner, and drying and oven at 121° C. for about 15 minutes. The second layer of the film adhesive was a solvent based pressure sensitive adhesive having a composition of 65 parts IOA, 30 parts methyl acrylate, and 5 parts AA made according to the method disclosed in Re24906 (Ulrich), incorporated herein by reference. A release liner was then placed over the solvent based pressure-sensitive adhesive, and the polyamide side of the film adhesive was pressure laminated to the

> foam. The tapes were tested for 90° peel adhesive, T-peel adhesion, tensile and elongation, and static shear strength. Test results and foam densities for all of the examples are shown in Table 1. (Gehlsen, col. 14, lines 45-61).

The foregoing disclosure describes the foam compositions for Examples 1-5 as having been made using "Hot Melt Composition 1" described at column 14, lines 29-34 and reproduced below:

> A pressure-sensitive adhesive composition was prepared by mixing 90 parts of IOA (isooctyl acrylate), 10 parts of AA (acrylic acid), 0.15 part 2,2 dimethoxy-2-phenylacetophenone (Irgacure™ 651 available from Ciba Geigy) and 0.03 parts of IOTG (isooctyl thioglycolate). The composition was placed into packages measuring approximately 10 cm by 5 cm by 0.5 cm thick packages as described in Assignee's co-pending patent application No. 08/919756. The packaging film was a 0.0635 thick ethylene vinyl acetate copolymer (VA-24 Film available from CT Film of Dallas, Tex.) The packages were immersed in a water bath and at the same time exposed to ultraviolet radiation at an intensity of 3.5 milliwatts per square centimeter and a total energy of 1627 millijoules per square centimeter as measured in NIST units to form a packaged pressure-sensitive-adhesive. The resulting adhesive had an IV (intrinsic viscosity of about 1.1 deciliters/gram, Mw of $5.6x10^5$ g/mol and Mn of $1.4x10^5$ g/mol. (Gehlsen, col. 12, line 66 through col. 13, line 16).

Nothing in the portions of the Gehlsen reference relied on by the Office teach or suggest the inclusion of a fire retardant in a foam article in combination with an adhesive layer free of fire retardant. Both the foam and the adhesives employed in Gehlsen's examples 1-5 are free of fire retardant. Applicant can discern no identifiable mention of a fire retardant material in any of the foregoing disclosure.

Applicant has acknowledged that Gehlsen, in a laundry list of potential additives, mentions the possibility of including "fire retardants" in the disclosed foam articles (see col. 8, lines 44-55). However, the mere mention of this broad class of materials within a laundry list of possible additives provides no motivation to the person of ordinary skill in the art to provide the formulations for the foamed articles described in the claims now being appealed. Gehlsen provides no motivation to the skilled artisan to choose any one item from Gehlsen's laundry list of additives

to formulate the fire retardant articles of the present invention. Even if the skilled artisan were to somehow focus on Gehlsen's generic identification of "fire retardants," nothing in the Gehlsen disclosure teaches or suggests the specific inclusion of antimony-free fire retardant in the foam layer, and certainly nothing suggest that antimony free fire retardant should or could successfully be included in the foam layer in combination with an adhesive layer formulated without fire retardant.

Parsons does not make up for the deficiencies of Gehlsen. Parsons discloses pressure-sensitive adhesive compositions comprising an adhesive selected from the group consisting of rubber resin adhesives and acrylic adhesives containing from about 10 to about 60 % by weight of adhesive of a non-halogen intumescent flame retardant (see, e.g., Abstract). For certain applications, where a thick adhesive is necessary, a "foam" pressure sensitive adhesive having cells throughout the adhesive can be generated by frothing (as disclosed, for example, in U.S. Pat. No. 4,415,615) or by incorporating glass hollow microspheres (as disclosed, for example, in U. S. Pat. No.4,233,067) or polymeric hollow microspheres (as disclosed, for example, in EP 257984 wherein the cells occupy 20-65% of the volume of the adhesive). However, Parsons does not suggest a flame retardant article, comprising an expanded polymeric foam material with expanded polymeric microspheres and antimony-free fire retardant in combination with an adhesive layer formulated without fire retardant.

In addition to the above matters, it should be appreciated that the expanded polymeric microspheres in the articles of the present invention comprise a polymer shell and a core material in the form of a gas, liquid, or combination thereof. During the foaming process used in the creation of the expanded polymeric foam material, the microspheres are initially heated so that the polymeric shell of each microsphere softens. The applied heat causes the core material within the microspheres to expand, and the internal pressure created by the expanding core material causes the softened polymeric shell to expand as well. Core materials for these polymeric microspheres can be any of several combustible gases (e.g., propane, butane, pentane, isobutane, neopentane, or similar material and combinations thereof) (see Application, page 9, lines 11-15). Because the foaming process is typically controlled, the expanded microspheres generally remain unbroken in the finished article.

In contrast to the articles described by Gehlsen, the present invention surprisingly provides fire retardant foam articles containing expanded, combustible polymeric microspheres. Because Gehlsen discloses the use of combustible microspheres, it was unexpected that a foam article made to comprise these combustible materials could be made to be fire retardant, especially in view of the concentration of expanded microspheres that may be present within the foam material of the present invention (e.g., up to about 20 parts by weight based on 100 parts by weight of polymer (see claim 1)). In addition to the microspheres, the skin adhesives used in the present invention, also will include combustible ingredients which, in the absence of fire retardant, are generally present in combustible amounts. Therefore, it is even more surprising that the foam articles of the invention can be made to be fire retardant even though they include expanded and combustible microspheres and a combustible skin adhesive layer associated with the foam.

The fire retardant articles of the invention may be used in applications that are generally unavailable to the articles of Gehlsen. Such applications include those described in the above "Summary Of The Invention" section (e.g., electric or electronic applications, rail transit and transportation applications, and aerospace applications) (see also Applicant's Specification page 20, lines 9-10 and claim 15).

For at least the foregoing reasons, the pending claims are all allowable over the combination of Gehlsen and Parsons.

II. Whether claims 13 and 14 are unpatentable under 35 U.S.C §103(a) in view of Gehlsen et al. (U.S. 6,103,152) and Parsons et al. (U.S. 5,851,663) as applied to claims 1 and further in view of Bonk et al. (U.S. 4,751,269).

Applicant respectfully submits that the additional rejections of dependent claims 13 and 14 need not be addressed here. It is believed that independent claim 1 is allowable over the cited art for at least the reasons set forth in this brief. With the reversal of the Office's rejection of claim 1, claims 13 and 14 are also allowable over the cited art.

III. Whether claim 23 is unpatentable under 35 U.S.C §103(a) in view of Gehlsen et al. (U.S. 6,103,152) and Parsons et al. (U.S. 5,851,663) as evidenced by Mochizuki et al. (U.S. 6,139,998).

Applicant respectfully submits that the remaining rejection of dependent claim 23 need not be addressed here. It is believed that independent claim 1 is allowable over the cited art for at least the reasons set forth in this brief. With the reversal of the Office's rejection of claim 1, claim 23 is also allowable over the cited art.

CONCLUSION

For the foregoing reasons, Applicant respectfully submits that the Office has erred in rejecting this application under 35 USC §103(a). Reversal of the Office's final rejection of pending claims 1, 2, 4-15 and 23 is now requested.

Respectfully submitted,

March 22, 2004
Date

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APPENDIX

1. A flame retardant article, comprising:

An expanded polymeric foam material comprising a polymer, antimony-free fire retardant, and a plurality of expanded polymeric microspheres, the foam material having an outer surface, the expanded polymeric foam material is a sheet and the outer surface comprises a first major surface and a second major surface; and

An adhesive layer formulated without fire retardant and disposed on at least a portion of one of the first or second major surfaces;

Wherein the amount of expanded polymeric microspheres is from about 0.1 parts by weight to about 20 parts by weight based on 100 parts by weight of polymer.

2. An article according to claim 1 wherein the article has a foam split strength greater than about 2.64 kN/m; 90 degree peel adhesion on stainless steel of greater than about 2.64 kN/m; and static shear strength at 22°C or 70°C of at least about 10, 000 minutes.

4. An article according to claim 1 wherein the adhesive layer is disposed on at least a portion of both the first and second major surfaces.

5. An article according to claim 1 wherein the polymeric foam material is selected from the group consisting of elastomers, rubbers, thermoplastic elastomers, rubber based and acrylic adhesives, polyolefin polymers, acrylate polymers and methacrylate polymers, acrylate and methacrylate copolymers, and combinations thereof.

6. An article according to claim 1 wherein the article has a thickness less than about 0.635 mm; and the adhesive layer comprising no greater than about 30 weight percent fire retardant based on the total weight of the adhesive layer.

7. An article according to claim 1 wherein the adhesive layer is selected from the group consisting of a copolymer of ethylhexyl acrylate and acrylic acid, a copolymer of isooctyl acrylate and acrylic acid, and a blend of an acrylic adhesive and rubber based adhesive.

8. An article according to claim 1 wherein the foam material comprises an acrylic adhesive.

9. An article according to claim 1 wherein the antimony free fire retardant is an intumescent material comprising an acid source, a char former, and a blowing agent.

10. An article according to claim 9, further comprising one or more synergists.

11. An article according to claim 10 wherein the synergists are selected from the group consisting of n-alkoxy hindered amine, tris(tribromoneopentyl)phosphate, melamine phosphate, melamine polyphosphate, boroxo siloxane elastomer, and monomeric n-alkoxyhindered amine.

12. An article according to claim 1 wherein the antimony free fire retardant is present in the foam at a concentration of between about 20 wt.% and about 60 wt.%.

13. An article according to claim 1 wherein one or both of the foam and the adhesive layer further comprises microfibers imparting stretch release properties to the article, the microfibers being selected from the group consisting of polymeric microfibers, viscoelastic microfibers, elastic microfibers, and combinations of the foregoing.

14. An article according to claim 13 wherein the microfibers comprise semicrystalline homopolymers, copolymers, terpolymers, tetrapolymers, and combinations of the foregoing of polyalkylene resins.

15. An article according to claim 1 wherein the article will pass one or more of the following the F.A.R.§ 25.853 (July 1990), 12 Second Vertical Burn Test; F.A.R.§ 25.853 (July 1990), 60 Second Vertical Burn Test; UL-94 V-2 rating; ASTM E162 with maximum flame spread index of 35; ASTM E662 with maximum specific optical density for flaming and nonflaming modes of 100 maximum (1.5 minutes) and 200 maximum (4.0 minutes); and BSS 7239.

23. The flame retardant article of claim1 wherein the antimony-free fire retardant is tris(bromoneopentyl)phosphate.